Endogenous determination of trade regime and bargaining outcome

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Abstract

We show that whether trade is one-way or two-way depends on wage strategies adopted by trade unions. The union's wage strategy choices themselves depend upon the conditions under which trade takes place, as well as upon the characteristics of both the labour and the product markets in the trading countries. The impact of economic integration on union choices and therefore upon both labour market and trade outcomes is shown to vary according to the nature of the prevailing trade regime. We generate testable hypotheses and discuss the implications for the development of econometric tests of these hypotheses.

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1 Introduction

Within the general literature on the changing nature of international trade and its implications for labour market outcomes, there is no clear consensus on the nature of the link between, on the one hand, trade openness and, on the other, wage determination and labour market outcomes (see, for example, Freeman (1995)). One of the crucial areas of work in the discipline of economics in the last ten years has concerned this very issue, and much progress has been made in developing empirical methodologies for examining trade and labour market data in order to gain insights into the processes and market mechanisms connecting them. The current paper attempts to make a theoretical contribution to the development of appropriate methodologies for the empirical analysis of the relationship between international trade and labour markets.

It is surprising that there is little consensus on the impact of trade openness and labour market outcomes. It is often argued that both the fact of - and even the potential threat of - international trade is likely to impose a more competitive product market discipline on wage-setters and that this should lead to a negative relationship between openness and wage levels, for example. There is some support for this view in the work of Stewart (1990) who finds that union-nonunion wage differentials are much lower in the presence of international market competition even when other conditions are favourable to a union wage influence. On the other hand, however, it has been argued that protected industries are less efficient, *ceteris paribus*, and this reduces the scope for workers to negotiate wage premia. There is evidence also in support of this argument (see, for example, Gaston and Trefler (1994)). A consequence of all this is that there is no consensus on how increased economic integration within trading regions or, more generally, reduced costs associated with trade, affect wage and employment outcomes.

In terms of direct evidence on the impact of transportation costs of trade on wages, there is some evidence that wages are higher when transport costs are lower. This is consistent with the theoretical work on intra-industry trade of Naylor (1998, 1999).

In the current paper, we consider a framework in which trade across imperfectly competitive product markets can be either two-way (intra-industry) or one-way (inter-industry). See Greenaway, Hine and Milner (1995) for an industry-level analysis of intra-industry trade for the UK. We consider the case of an international duopoly and assume that the domestic firm confronts a (monopoly) trade union. We are interested primarily in the union's preferences over the level of the wages it will seek to negotiate with the firm. We show that the union has a dichotomous choice between a 'high' and a 'low' wage strategy. If it selects the low-wage strategy, then its employer will incur labour costs sufficiently low that it will be able to export abroad. Conversely, with a high-wage strategy selected by the union, the firm will incur labour costs such that it is unable to compete in the foreign market. We show how the union's choice of strategy - and its corresponding strategy-contingent wage - and therefore the trade outcome, depend upon a vector of factors. These factors include: the extent of trade costs, the nature of competition between the firms in the product market, the degree of differentiation between the firms' products, the nature of union preferences, the level of reservation wages in the two countries and the parameters of product market demand.

In particular, we examine how a change in trade costs influences the union's wage strategy choice. We show that the union's optimal wage responds differentially to a fall in trade costs according to whether trade is one-way or two-way. We also show that this is an endogenous outcome: there is a critical or 'switching' level of trade costs which induces the union to switch between high and low wage strategies and therefore causes

the firm to switch between export and non-export behaviour. This has important implications for empirical modelling. If trade is one-way, then a fall in the costs of international trade leads the union to reduce its wage demand. If, on the other hand, trade is two-way then a fall in trade costs has the opposite effect. This, of course, is a clear testable proposition which can be addressed with appropriate micro-data. It is also consistent with an ambiguity concerning the impact of trade protection on wages. Our analysis also suggests that the issue of endogeneity between the nature of the trade regime and labour market behaviour is crucial. One cannot simply partition the data according to whether trade is one-way or two-way as this is itself influenced by union behaviour and thus by the extent of trade costs. We need to be able to identify the determinants of the union's choice over its wage strategy and, in particular, the determinants of the critical trade cost which induces the union to switch behaviour. This is the main focus of the current paper.

The rest of the current paper is organised as follows. Section 2 outlines the basic model and presents the derivation of particular testable propositions. Section 3 examines the issue of the endogeneity between trade regime and union behaviour and draws conclusions for identifying the crucial 'switching' function. Section 4 closes the paper with general conclusions and suggestions for further research.

2 Theoretical framework

Consider a situation in which a domestic monopoly firm faces potential competition in its home market from a foreign firm. Assume that trade costs are initially so high as to prohibit import penetration from abroad, given other parameters, such as wage costs. As trade costs fall, the foreign firm is just able to break into the market,

ceteris paribus. If the home firm is unionised, however, its union may be prepared to accept a lower union wage premium in order to keep out the foreign competition and hence protect jobs. Figure 1 depicts such a case, and shows that there comes a point when trade costs are so low that further reductions induce the union to further cuts in its wage, but not by so much as to prevent import penetration.

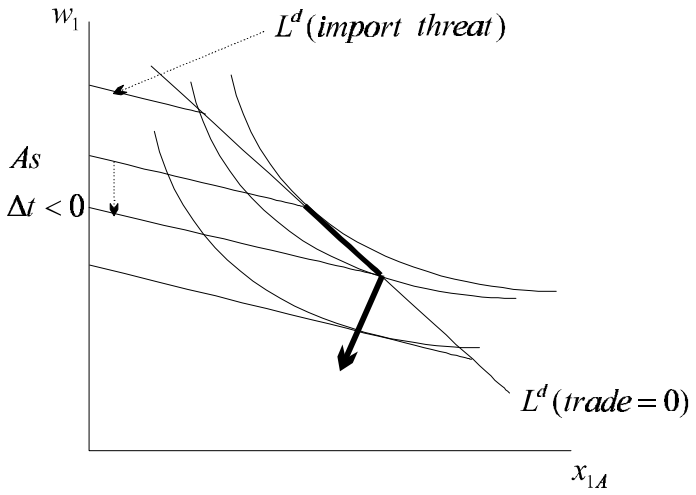

Figure 1 Union wage response to reductions in trade protection (one-way trade)

2.1 One-way trade

We now consider the formal analysis behind the situation described above. Suppose that in Country A product demand facing the home firm (Firm 1) and the foreign firm (Firm 2) is given by:

$$p_{1A} = a - cx_{2A} - x_{1A}, \qquad (1)$$

where x_{1A}, for example, represents supply by Firm 1 to market A and c represents the extent of product market substitutability, $-1 \le c \le 1$. If $c = 1$ then goods are perfect substitutes, if $c = -1$ they are perfect complements and if $c = 0$ then they are independent. As c tends to unity we refer to them as becoming more similar. This approach follows Singh and Vives (1984) and has been exploited by Horn and Wolinsky

(1988), though not in the context of international trade. Similarly, for Firm 2, demand is given by:

$$p_{2A} = a - cx_{1A} - x_{2A}. \quad (2)$$

We now consider the game in two stages. In Stage 1, the wage in Firm 1 is determined by a trade union. In Stage 2, the two firms choose output levels. We proceed by the customary method of backward induction.

2.1.1 Stage 2

From (1) it follows that the profits of Firm 1 will be given by:

$$p_{1A} = (a - cx_{2A} - x_{1A} - w_1)x_{1A} \quad (3)$$

where w_1 is the wage paid by Firm 1. An analogous expression holds for the profits of Firm 2, but with the addition of a cost, t, representing the per unit trade cost:

$$p_{2A} = (a - cx_{1A} - x_{2A} - w_2 - t)x_{2A} \quad (4)$$

The first-order condition for profit maximisation by Firm 1 can be derived as:

$$\frac{dp_{1A}}{dx_{1A}} = a - c(x_{2A} + mx_{1A}) - w_1 - 2x_{1A} = 0 \quad (5)$$

with an equivalent expression defining profit maximisation by Firm 2:

$$\frac{dp_{2A}}{dx_{2A}} = a - c(x_{1A} + mx_{2A}) - w_2 - 2x_{2A} = 0 \quad (6)$$

where $\frac{dx_{2A}}{dx_{1A}} = m$ is the product market conjectural variation parameter capturing how Firm 1 believes Firm 2 will respond to a change in its output. It is assumed to be symmetric across the two firms. If $m = 0$, then this represents the usual Cournot assumption. An increase in m implies an increase in the extent of collusion between the two firms over their output levels. From (5) and (6), we can derive the two firms' best-reply functions in output-space. These are given by:

$$x_{1A} = \frac{1}{2+cm}\left[a - w_1 - cx_{2A}\right] \tag{7}$$

and

$$x_{2A} = \frac{1}{2+cm}\left[a - w_2 - t - cx_{1A}\right] \tag{8}$$

From these expressions, it is clear that the slopes of the best-reply functions depend on the degree of substitutability/complementarity between the two firms' products. The best-reply functions are negatively-sloped if the goods are gross substitutes and positively-sloped in the case of gross substitutes.

We can re-arrange (7) and (8) in order to derive the labour demand relation facing Union 1, the union of workers in Firm 1:

$$x_{1A} = \frac{1}{(2+cm)^2 - c^2}\left\{\left[2 - c(1-m)\right]a - (2+cm)w_1 + cw_2 + ct\right\} \tag{9}$$

We can now analyse the union's Stage 1 choice of the wage level.

2.1.2 Stage 1

We assume that the union objective can be captured by the specific functional form:

$$U_1 = (w_1 - \overline{w})^q x_{1A} \tag{10}$$

where q represents the relative weight the union attaches to the wage argument in its utility function. If q equals unity, then this is the special case of rent-maximisation by the union. Substituting (9) in (10) and solving for the first-order condition for union utility maximisation yields a monopoly union wage choice of:

$$w_1 = \frac{1}{(2+cm)(1+q)}\left\{q\left[2 - c(1-m)\right]a + cqw_2 + cqt + (2+cm)\overline{w}\right\} \tag{11}$$

From (11), we are able to establish a number of results concerning the union's choice of the wage and how this will depend on particular parameters of the model. These are summarised in a series of propositions.

Proposition 1 Under one-way trade, the union's chosen wage will be increasing in the reservation wage.

Proof It is readily seen from (11) that $\frac{dw_1}{d\overline{w}} > 0$. This is a well-established result.

Proposition 2 Under one-way trade, the union's chosen wage will be increasing in q, the relative weight on wages in the union's utility function.

Proof It can be checked from (11) that $\frac{dw_1}{dq} > 0$. This result is intuitive.

Proposition 3 Under one-way trade, the union's chosen wage will be increasing in the wage paid by the rival firm if the firms' products are gross substitutes. If products are gross complements, then the union's best-reply function is negatively-sloped.

Proof It is readily seen from (11) that $\frac{dw_1}{dw_2}$ takes the same sign as c. This confirms the result established by Horn and Wolinsky (1988) for bilateral monopoly.

Proposition 4 Under one-way trade, the union's chosen wage will be increasing in the degree of product market collusion.

Proof It can be checked from (11) that $\frac{dw_1}{dm} > 0$.

Proposition 5 Under one-way trade, the union's chosen wage will be decreasing in the degree of product substitutability.

Proof It can be checked from (11) that $\frac{dw_1}{dc} < 0$. Thus, the more similar are traded products, the lower will be the union's chosen wage.

Proposition 6 Under one-way trade, the union's chosen wage will be increasing in t, the extent of costs associated with international trade, if products are gross substitutes.

Proof It can be checked from (11) that:

$$sign\left[\frac{dw_1}{dt}\right] = sign[c], \tag{12}$$

and hence that $sign\left[\frac{dw_1}{dt}\right] = sign[c]$, which establishes both Propositions 6 and 7.

Proposition 7 Under one-way trade, the union's chosen wage will be decreasing in t if products are gross complements.

It follows from Proposition 6 that, if goods are gross substitutes, increased economic integration will lead unions to reduce the wage level they try to bargain. This is the situation described graphically in Figure 1 above. The greater the degree of substitutability between products - the more similar or homogeneous they are - the more sensitive will be wages to a reduction in trade costs.

Finally, substituting (11) in (10), we obtain an expression for the union's optimal level of utility under one-way trade:

$$U_1^I = A\left\{\left[2 - c(1-m)\right]a + cw_2 + ct - (2+cm)\overline{w}\right\}^{1+q} \tag{13}$$

where $A = \left[\frac{q}{(2+cm)(1+q)}\right]^q \left[\frac{1}{(2+cm)^2 - c^2}\right]\left[\frac{1}{1+q}\right]$. We will make use of this result in the next section of the paper when we consider the union's choice between high and low wage strategies. First, we turn to consider the case of two-way trade.

2.2 Two-way trade

We now consider the situation in which Union 1 adopts a low-wage strategy which enables Firm 1 to export to Country B, the foreign market. We allow for the possibility that the foreign firm continues to export into Firm 1's home market.

2.2.1 Stage 2

The product market in Country B is assumed to be identical to that in Country A. Thus, by analogy from (7) and (8), it is readily shown that exports by Firm 1 are given by:

$$x_{1A} + x_{1B} = \frac{1}{(2+cm)^2 - c^2}\left\{\left[2 - c(1-m)\right]a - (2+cm)w_1 + cw_2 - (2+cm)t\right\} \qquad (14)$$

Hence, the sum of (7) and (14) gives the total labour demand facing Union 1. We can now consider the union's wage choice subject to this labour demand, where the union utility function is as before and employment consists of $x_{1A} + x_{1B}$. Thus,

$$U_1 = (w_1 - \overline{w})^q (x_{1A} + x_{1B}) \qquad (15)$$

2.2.2 Stage 1

The union will choose the wage to maximise U_1 as given by (15). The first order condition for a maximum gives an optimal wage of:

$$w_1 = \frac{1}{2(2+cm)(1+q)}\left\{2q\left[2-c(1-m)\right]a + 2cqw_2 - q\left(2-c(1-m)\right)t + 2(2+cm)\overline{w}\right\} \qquad (16)$$

From (16), we can derive various important comparative static properties of the model under two-way trade. Again, these are stated in the form of a series of propositions.

Proposition 8 Under two-way trade, the union's chosen wage will be increasing in the reservation wage.

Proof It is readily seen from (16) that $\frac{dw_1}{d\overline{w}} > 0$. This is consistent with the result obtained under the assumption of one-way trade.

Proposition 9 Under two-way trade, the union's chosen wage will be increasing in q, the relative weight on wages in the union's utility function.

Proof It can be checked from (16) that $\frac{dw_1}{dq} > 0$. Again, this result is as before.

Proposition 10 Under two-way trade, the union's chosen wage will be increasing in the wage paid by the rival firm if the firms' products are gross substitutes. If products are gross complements, then the union's best-reply function is negatively-sloped.

Proof It is readily seen from (16) that $\frac{dw_1}{dw_2}$ takes the same sign as c. Again, this result is as established for the case of one-way trade.

Proposition 11 Under two-way trade, the union's chosen wage will be increasing in the degree of product market collusion.

Proof It can be checked from (16) that $\frac{dw_1}{dm} > 0$.

Proposition 12 Under two-way trade, the union's chosen wage will be decreasing in the degree of product substitutability.

Proof It can be checked from (16) that $\frac{dw_1}{dc} < 0$. Thus, the more similar are traded products, the lower will be the union's chosen wage.

Proposition 13 Under two-way trade, the union's chosen wage will be decreasing in t, the extent of costs associated with international trade.

Proof It can be checked from (16) that:

$$\frac{dw_1}{dt} = \frac{-\left[2 - c(1-m)q\right]}{2(2+cm)(1+q)} < 0 \qquad (17)$$

This is the key result of this Section of the paper. We have found that for goods which are gross substitutes, the impact on the union's chosen wage level of a rise in trade costs is negative under two-way trade and positive under one-way trade. This generalises the results of Naylor (1999) for a much more general model. The testable hypothesis is clear: where firms are engaged in exporting abroad, a fall in trade costs will lead unions to raise wages, whereas if firms are not exporting the opposite response will occur. This is for the case of gross substitutes. With gross complements, union wages will be rising as trade costs fall independent of the trade regime.

We now have to ascertain the conditions under which trade will be one-way or two-way as this is an endogenous outcome. Hence, we cannot simply partition trade data into one-way or two-way regimes and examine the effects of trade costs on wages separately in the two regimes.

In order to determine which trade regime will obtain, we need to compare union utility under the two regimes. (13) gives union utility under a one-way regime induced by a union high-wage strategy. Substituting (16) in (15), we obtain an expression for the union's optimal level of utility under two-way trade:

$$U_1^{II} = B\left\{2\left[2-c(1-m)\right]a + 2cw_2 - \left[2-c(1-m)\right]t - 2(2+cm)\overline{w}\right\}^{1+q} \qquad (18)$$

where $B = \left[\frac{q}{2(2+cm)(1+q)}\right]^q \left[\frac{1}{(2+cm)^2 - c^2}\right]\left[\frac{1}{1+q}\right]$.

We have now, in (13) and (18), derived the union utility levels under each of the two kinds of trade regime and hence we are in a position to examine the union's choice across the two: that is, we analyse the union's decision on whether to opt for the high-wage strategy or the low-wage strategy. This is the focus of the next Section of the paper.

3 One-way or two-way trade?

The union will choose to set a high-wage strategy if $U_1^I > U_1^{II}$, as in this case the high-wage strategy induced one-way trade regime yields to the union greater utility than the two-way trade regime facilitated by a low-wage strategy. The union is indifferent between the two regimes if $U_1^I = U_1^{II}$: that is, if

$$k\left\{\left[2-c(1-m)\right]a + cw_2 - (2+cm)\overline{w}\right\}$$

$$= \left\{2\left[2-c(1-m)\right]a + 2cw_2 - \left[2-c(1-m)\right]t - 2(2+cm)\overline{w}\right\} \qquad (19)$$

where $k = 2^{q/(1+q)}$. We can solve (19) to find the critical value of trade costs for which the union is just indifferent between the high-wage and the low-wage strategies: we call this the switching or prohibitive level of trade costs under unions, t_p^U and it is given by:

$$t_p^U = \frac{2-k}{2+c(k-1+m)}\left\{\left[2-c(1-m)\right]a + cw_2 - (2+cm)\overline{w}\right\} \qquad (20)$$

From (20), we can derive a number of comparative static properties concerning this prohibitive level of trade costs under unions. These are summarised in a series of propositions.

Proposition 14 If $t > t_p^U$, then the union prefers the high-wage strategy: trade costs are sufficiently high as to preclude the possibility of exports from Country A, given the parameters of the model and, particularly, the nature of union preferences. If, on the other hand, $t < t_p^U$, then the union prefers the low-wage strategy and hence trade will be two-way.

Proof The proof follows from comparison of (13) and (18).

Proposition 15 The switching level of trade costs is increasing in the reservation price, a: rendering two-way trade more likely the higher is a.

Proof From (20), it follows that, under the assumptions we have made, $\frac{dt_p^U}{da} > 0$. The intuition is that the greater is the reservation price, the greater are the potential gains from trade and hence the more likely the union to accommodate trade through a low wage strategy.

Proposition 16 The switching level of trade costs is decreasing in the domestic reservation wage: rendering two-way trade more likely the higher is $\overline{w}$.

Proof From (20), $\frac{dt_p^U}{d\overline{w}} < 0$. The intuition is that the lower is the reservation wage at home, the greater is the potential gain to the union within the home market, and consequently the lower is the incentive to accommodate two-way trade.

Proposition 17 In the case of gross substitutes, the switching level of trade costs is increasing in the foreign wage: rendering two-way trade more likely the higher is the foreign wage.

Proof From (20), $\frac{dt_p^U}{dw_2} = \frac{(2-k)c}{2+c(k-1+m)}$ which is positive if c is positive. This result is intuitive. If c is negative, the opposite result obtains. This establishes proposition 18.

Proposition 18 In the case of gross complements, the switching level of trade costs is decreasing in the foreign wage: rendering two-way trade less likely the higher is the foreign wage.

Proposition 19 The switching level of trade costs is decreasing in the degree of homogeneity of the product: rendering two-way trade less likely the more closely substitutable are the firms' outputs (the greater is c).

Proof From (20), $\frac{dt_p^U}{dc} < 0$. The intuition is that the more highly substitutable are the two firms' products, the lower are the potential capturable gains for the union from a low-wage strategy of accommodating trade.

Proposition 20 The switching level of trade costs is decreasing in the degree of product market collusion between the firms: rendering two-way trade less likely the more monopolistic is the domestic product market.

Proof From (20), $\frac{dt_p^U}{dm} < 0$. The intuition is that the more the firms collude in the home market, the greater is the potential rent to the union within the home market, and consequently the lower is the incentive to accommodate two-way trade.

Proposition 21 At least under Cournot-Nash equilibria in the product market, the switching level of trade costs in the presence of a union is less than that in a competitive labour market: rendering two-way trade less likely in a unionised labour market.

Proof It is straightforward to show that in the absence of unions, the prohibitive trade cost is given by:

$$t_p^N = \frac{1}{2}\{(2-c)a + cw_2 - 2\overline{w}\} \qquad (21)$$

Comparison of (20) and (21) reveals that $t_p^U < t_p^N$, at least in the case of Cournot equilibrium in the product market (m =0). From this it follows that trade is less likely in the presence of unions, which establishes the proposition.

In this Section of the paper, we have shown that whether the trade regime will be characterised by one-way or two-way trade depends on the level of trade costs relative to a critical or 'prohibitive' level. This prohibitive level itself depends upon various economic factors relating to the nature of product market competition and to labour market behaviour. Our analysis carries an important implication for attempts to test empirically the nature of the relationship between trade costs and labour market

outcomes. Our theory predicts that, in a unionised setting, if trade costs exceed the prohibitive level for exporting - so that any trade is one-way - then a marginal fall in trade costs will be likely to provoke a fall in the wage level. Conversely, if trade costs are less that the prohibitive level - so that exports do occur - then a reduction in trade costs will lead to higher wages. In order to test this prediction of the model against, say, firm-level micro-data, one would need to regress firm-level wages against the level of trade costs, with a model of the selection process in which the observed event of exporting or not depends on the level of trade costs relative to a latent variable, t_p^U, the determinants of which have been the focus of this Section of the paper.

4 Conclusions

In this paper, we have developed a generalisation of the models developed in Naylor (1998, 1999) on the (endogenous) relationship between trade and labour markets. A main focus has concerned the implications of the theoretical analysis for the development of empirical models of trade and wages. The central proposition of the theoretical model is that the direction of the effect of falling trade costs on wages will vary according to whether trade is one-way or two-way. This could represent a possible explanation for ambiguous empirical evidence on the relationship between wages, on the one hand, and indicators of trade openness and protection, on the other. Furthermore, the partition of firms across the two sectors - one-way trade or two -way trade - is itself an endogenous outcome: with obvious and important implications for the empirical analysis of the relationship between trade and labour markets. Our theoretical analysis has suggested that the nature of the trade regime will depend upon the level of trade

costs relative to a critical level. Empirically, this critical level is a latent variable, the determinants of which have been the focus of much of our analysis.

The theoretical model we have developed extends previous work in a number of important directions. In particular, the implications we have drawn out for empirical analysis represent novel innovations. With respect to the theoretical model itself, previous work of the kind has not taken account of the importance of product market behaviour, product differentiation or union preferences. There are, however, directions in which the work might be pursued further. In particular, the model as developed so far focuses on the case of a monopoly union. It is possible to demonstrate, using numerical methods, that the central results carry over to the more general case of the right-to-manage model, but no more general results have yet been obtained. A second direction for future work would involve developing a more general framework than that developed in this paper, where we have concentrated on specific functional forms in order to obtain precise algebraic solutions to the particular problems we have addressed.

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